

DULWICH COLLEGE SHANGHAI

ADDITIONAL MATHS
MATRICES AND COORDINATE GEOMETRY

TIME 50 MINS

Draw a line under each completed question before you start another.
All answers must be labelled eg (ii) and placed on the right hand side.

- 1) (a) The matrices \mathbf{A} , \mathbf{B} and \mathbf{C} are given by $\mathbf{A} = \begin{pmatrix} 2 & 1 \\ 1 & 3 \\ 2 & 5 \end{pmatrix}$, $\mathbf{B} = \begin{pmatrix} 2 & 1 & 3 & 4 \\ 1 & 5 & 6 & 7 \end{pmatrix}$ and $\mathbf{C} = \begin{pmatrix} 9 \\ 10 \end{pmatrix}$. Write down, but do not evaluate, matrix products which may be calculated from the matrices \mathbf{A} , \mathbf{B} and \mathbf{C} . [2]

- (b) Given that $\mathbf{X} = \begin{pmatrix} 2 & 4 \\ 3 & 5 \end{pmatrix}$ and $\mathbf{Y} = \begin{pmatrix} 2x & 3y \\ x & 4y \end{pmatrix}$, find the value of x and of y such that $\mathbf{X}^{-1}\mathbf{Y} = \begin{pmatrix} -12x + 3y & 6 \\ -7x + 3y & 6 \end{pmatrix}$. [6]

- 2) The points A and B have coordinates $(-2, 15)$ and $(3, 5)$ respectively. The perpendicular to the line AB at the point A $(-2, 15)$ crosses the y -axis at the point C . Find the area of the triangle ABC . [6]

- 3) (i) Given that $\mathbf{A} = \begin{pmatrix} 2 & 1 \\ -2 & 5 \end{pmatrix}$, find the inverse of the matrix $\mathbf{A} + \mathbf{I}$, where \mathbf{I} is the identity matrix. [3]
- (ii) Hence, or otherwise, find the matrix \mathbf{X} such that $\mathbf{AX} + \mathbf{X} = \mathbf{B}$, where $\mathbf{B} = \begin{pmatrix} 14 \\ 4 \end{pmatrix}$. [2]

- 4) The line $y = 3x - 9$ intersects the curve $49x^2 - y^2 + 42x + 8y = 247$ at the points A and B . Find the length of the line AB . [7]

- 5) (i) Given that $\mathbf{A} = \begin{pmatrix} 4 & 3 \\ -8 & -2 \end{pmatrix}$, find \mathbf{A}^{-1} . [2]
- (ii) Hence find the matrix \mathbf{M} such that $\begin{pmatrix} 4 & 3 \\ -8 & -2 \end{pmatrix} \mathbf{M} = \begin{pmatrix} 1 & 4 \\ 2 & 3 \end{pmatrix}$. [3]

6) **Solutions to this question by accurate drawing will not be accepted.**

The points $A(1, 4)$, $B(3, 8)$, $C(13, 13)$ and D are the vertices of a trapezium in which AB is parallel to DC and angle BAD is 90° . Find the coordinates of D . [6]

7) In a competition the contestants search for hidden targets which are classed as difficult, medium or easy. In the first round, finding a difficult target scores 5 points, a medium target 3 points and an easy target 1 point. The number of targets found by the two contestants, Claire and Denise, are shown in the table.

Contestant \ Target	Difficult	Medium	Easy
Claire	4	1	7
Denise	2	5	1

In the second round, finding a difficult target scores 8 points, a medium target 4 points and an easy target 2 points. In the second round Claire finds 2 difficult, 5 medium and 2 easy targets whilst Denise finds 4 difficult, 3 medium and 6 easy targets.

- (i) Write down the sum of two matrix products which, on evaluation, would give the total score for each contestant. [3]
- (ii) Use matrix multiplication and addition to calculate the total score for each contestant. [2]
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